Reference hydrometeor distributions.

Since radar reflectivity is such a strange moment of the hydrometeor size distribution, it is difficult to intuitively relate observed reflectivities to cloud composition. As a guide to making the link, a number of different size distributions were created and the corresponding reflectivities, plus other parameters, were calculated.

The size distributions were derived from the two-parameter gamma distribution. Varying the parameters *a* and *b,* yielded distributions with different modes and different widths. The integral number of the distribution (total droplet concentration) was adjusted to yield a uniform LWC of 1 g/m3.

Fig. 1 shows 15 such sample distributions and calculated values of total concentration *N,* reflectivity *Z*, rain rate *R* and reflectivity-weighted fall velocity *V*. For given distribution shapes, if *N* and/or *LWC* are given values to match some observed condition, then the following changes result: *LWC* and *R* changes linearly with *N*; *Z* changes with 10*log of the ratio of actual to nominal values of *N* or *LWC* i.e. a doubling of either *N* or of *LWC* will raises *Z* by 10*log2 = 3 dBZ. The value of *V* remains the same.

Note that the distributions in Fig. 1 are displayed in a binned format to match that of the UW King Air data archive. This was done only for convenience and does not restrict the results in any way.

As an added curiosity, Z-R, V-R and V-Z relationships were generated for the 15 sample distributions. These results are shown in Fig. 2. A power-law equation fits the Z-R data quite well for R<2mm/h.